TOPIC: 192008
KNOWLEDGE: K1.01 [3.4/3.5]
QID: P565

During a reactor startup, the first reactivity addition caused the stable source range count rate to increase from 20 cps to 40 cps. The second reactivity addition caused the stable count rate to increase from 40 cps to 160 cps.

Which one of the following statements accurately compares the two reactivity additions?

A. The first reactivity addition was larger.

B. The second reactivity addition was larger.

C. The first and second reactivity additions were equal.

D. There is not enough information given to compare the reactivity values.

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.01 [3.4/3.5]
QID: P1665

During a reactor startup, the first positive reactivity addition caused the stable source range count rate to increase from 20 cps to 30 cps. The second positive reactivity addition caused the stable count rate to increase from 30 cps to 60 cps. K_{eff} was 0.97 prior to the first reactivity addition.

Which one of the following statements accurately compares the reactivity additions?

A. The first and second reactivity additions were approximately equal.

B. The first reactivity addition was approximately twice as large as the second.

C. The second reactivity addition was approximately twice as large as the first.

D. There is not enough information given to compare the reactivity values.

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.02 [2.8/3.1]
QID: P3366

A nuclear power plant was operating at steady-state 100 percent power near the end of a fuel cycle when a reactor trip occurred. Four hours after the trip, with reactor coolant temperature at normal no-load temperature, which one of the following will cause the fission rate in the reactor core to increase?

A. The operator fully withdraws one bank/group of control rods.

B. Reactor coolant temperature increases by 3°F.

C. Reactor coolant boron concentration increases by 10 ppm.

D. An additional two hours is allowed to pass with no other changes in plant parameters.

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.02 [2.8/3.1]
QID: P3464

A nuclear power plant was operating at steady-state 100 percent power near the end of a fuel cycle when a reactor trip occurred. Four hours after the trip, reactor coolant temperature is currently being maintained at normal no-load temperature in anticipation of commencing a reactor startup.

At this time, which one of the following will cause the fission rate in the reactor core to decrease?

A. The operator fully withdraws one bank/group of control rods.

B. Reactor coolant temperature decreases by 3°F.

C. Reactor coolant boron concentration decreases by 10 ppm.

D. An additional 2 hours is allowed to pass with no other changes in plant parameters.

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.03 [3.9/4.0]
QID: P65 (B266)

While withdrawing control rods during a reactor startup, the stable source range count rate doubled. If the same amount of reactivity that caused the first doubling is added again, the stable count rate will _____; and the reactor will be _____.

A. more than double; subcritical

B. more than double; critical

C. double; subcritical

D. double; critical

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.03 [3.9/4.0]
QID: P265

A reactor startup is in progress and the reactor is slightly subcritical in the source range. Assuming the reactor remains subcritical, a short control rod <u>withdrawal</u> will cause the reactor startup rate indication to increase sharply in the positive direction, and then...

A. rapidly decrease and stabilize at a negative 1/3 dpm.

B. gradually decrease and stabilize at zero.

C. stabilize until the point of adding heat (POAH) is reached; then decrease to zero.

D. continue increasing until the POAH is reached; then decrease to zero.

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.03 [3.9/4.0]
QID: P448 (B1949)

A subcritical reactor has a stable source range count rate of 150 cps with a shutdown reactivity of -2.0 %ΔK/K. How much positive reactivity must be added to establish a stable count rate of 300 cps?

A. 0.5 %ΔK/K

B. 1.0 %ΔK/K

C. 1.5 %ΔK/K

D. 2.0 %ΔK/K

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.03 [3.9/4.0]
QID: P848 (B2149)

A subcritical reactor has an initial K_{eff} of 0.8 with a stable source range count rate of 100 cps. If positive reactivity is added until K_{eff} equals 0.95, at what value will the count rate stabilize?

A. 150 cps

B. 200 cps

C. 300 cps

D. 400 cps

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.03 [3.9/4.0]
QID: P1065 (B1565)

During a reactor startup, equal amounts of positive reactivity are being sequentially added, and the source range count rate is allowed to reach equilibrium after each addition. Which one of the following statements applies for each successive reactivity addition?

A. The time required to reach equilibrium count rate is the same.

B. The time required to reach equilibrium count rate is shorter.

C. The numerical change in equilibrium count rate is greater.

D. The numerical change in equilibrium count rate is the same.

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.03 [3.9/4.0]
QID: P1166

Which one of the following describes the prompt jump and the change in stable source range count rate resulting from a short control rod withdrawal with K_{eff} at 0.95 as compared to an identical control rod withdrawal with K_{eff} at 0.99? (Assume the reactivity additions are equal, and the reactor remains subcritical.)

A. The prompt jump in count rate will be the same, and the increase in stable count rate will be the same.

B. The prompt jump in count rate will be greater with K_{eff} at 0.99, but the increase in stable count rate will be the same.

C. The prompt jump in count rate will be the same, but the increase in stable count rate will be greater with K_{eff} at 0.99.

D. The prompt jump in count rate will be greater with K_{eff} at 0.99, and the increase in stable count rate will be greater with K_{eff} at 0.99.

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.03 [3.9/4.0]
QID: P1348 (B1449)

A reactor is shut down by 1.8 %ΔK/K. Positive reactivity is added that increases the stable source range count rate from 15 cps to 300 cps.

What is the current value of K_{eff}?

A. 0.982

B. 0.990

C. 0.995

D. 0.999

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.03 [3.9/4.0]
QID: P1448 (B1849)

A subcritical reactor has a stable source range count rate of 150 cps with a shutdown reactivity of -2.0 %ΔK/K. Approximately how much positive reactivity must be added to establish a stable count rate of 600 cps?

A. 0.5 %ΔK/K

B. 1.0 %ΔK/K

C. 1.5 %ΔK/K

D. 2.0 %ΔK/K

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.03 [3.9/4.0]
QID: P1748

A subcritical reactor has a stable source range count rate of 60 cps with a shutdown reactivity of -2.0 %ΔK/K. How much positive reactivity must be added to establish a stable count rate of 300 cps?

A. 0.4 %ΔK/K

B. 0.6 %ΔK/K

C. 1.4 %ΔK/K

D. 1.6 %ΔK/K

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.03 [3.9/4.0]
QID: P1766 (B2165)

A reactor startup is in progress with the reactor currently subcritical.

Which one of the following describes the change in source range count rate resulting from a short control rod withdrawal with K_{eff} at 0.95 as compared to an identical control rod withdrawal with K_{eff} at 0.99? (Assume the reactivity additions are equal and the reactor remains subcritical.)

A. Both the prompt jump in count rate and the increase in stable count rate will be the same.

B. Both the prompt jump in count rate and the increase in stable count rate will be smaller with K_{eff} at 0.95.

C. The prompt jump in count rate will be smaller with K_{eff} at 0.95, but the increase in stable count rate will be the same.

D. The prompt jump in count rate will be the same, but the increase in stable count rate will be smaller with K_{eff} at 0.95.

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.03 [3.9/4.0]
QID: P2466 (B2465)

A reactor startup is being performed by adding equal amounts of positive reactivity and waiting for neutron population to stabilize. As the reactor approaches criticality, the numerical change in stable neutron population resulting from each reactivity addition will _____; and the time required for the neutron population to stabilize after each reactivity addition will _____.

A. increase; remain the same

B. increase; increase

C. remain the same; remain the same

D. remain the same; increase

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.03 [3.9/4.0]
QID: P2448 (B2649)

A reactor startup is being performed with xenon-free conditions. Control rod withdrawal is stopped when K_{eff} equals 0.995 and source range count rate stabilizes at 1,000 cps. No additional operator actions are taken.

Which one of the following describes the count rate 20 minutes after rod withdrawal is stopped?

A. Less than 1,000 cps and decreasing toward the prestartup count rate.

B. Less than 1,000 cps and stable above the prestartup count rate.

C. Greater than 1,000 cps and increasing toward criticality.

D. 1,000 cps and constant.

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.03 [3.9/4.0]
QID: P2467

A reactor startup is in progress. The reactor is slightly subcritical with a constant startup rate of 0.0 dpm. A short control rod insertion will cause the reactor startup rate indication to initially become negative, and then...

A. gradually become less negative and return to 0.0 dpm.

B. gradually become more negative until the neutron population reaches the source range equilibrium level, and then return to 0.0 dpm.

C. stabilize until the neutron population reaches the source range equilibrium level, and then return to 0.0 dpm.

D. stabilize at -1/3 dpm until fission neutrons are no longer a significant contributor to the neutron population, and then return to 0.0 dpm.

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.03 [3.9/4.0]
QID: P3048 (B3049)

A reactor startup is being commenced with initial source range count rate stable at 20 cps. After a period of control rod withdrawal, count rate stabilizes at 80 cps.

If the total reactivity added by the above control rod withdrawal is 4.5 %ΔK/K, how much additional positive reactivity must be inserted to make the reactor critical?

A. 1.5 %ΔK/K

B. 2.0 %ΔK/K

C. 2.5 %ΔK/K

D. 3.0 %ΔK/K

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.03 [3.9/4.0]
QID: P3348

A xenon-free shutdown nuclear power plant is slowly cooling down due to an unisolable steam leak. The leak began when reactor coolant temperature was 400°F and the readings on all source range channels were 80 cps. Currently, reactor coolant temperature is 350°F and all source range channels indicate 160 cps.

Assume the moderator temperature coefficient remains constant throughout the cooldown, and no operator action is taken. What will the status of the reactor be when reactor coolant temperature reaches 290°F?

A. Subcritical, with source range count rate less than 320 cps.

B. Subcritical, with source range count rate greater than 320 cps.

C. Supercritical, with source range count rate less than 320 cps.

D. Supercritical, with source range count rate greater than 320 cps.

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.03 [3.9/4.0]
QID: P3925 (B3925)

A reactor startup is in progress with K_{eff} initially equal to 0.90. By what factor will the core neutron level increase if the reactor is stabilized when K_{eff} equals 0.99?

A. 10

B. 100

C. 1,000

D. 10,000

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.03 [3.9/4.0]
QID: P4225 (B4225)

A reactor is shutdown with a K_{eff} of 0.96 and a stable source range count rate of 50 cps when a reactor startup is commenced. Which one of the following will be the stable count rate when K_{eff} reaches 0.995?

A. 400 cps

B. 800 cps

C. 4,000 cps

D. 8,000 cps

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.03 [3.9/4.0]
QID: P4525 (B4525)

A nuclear power plant is being cooled down from 500°F to 190°F. Just prior to commencing the cooldown, the source range count rate was stable at 32 cps. After two hours, with reactor coolant temperature at 350°F, the source range count rate is stable at 64 cps.

Assume the moderator temperature coefficient remains constant throughout the cooldown and reactor power remains below the point of adding heat.

Without additional operator action, what will the status of the reactor be when reactor coolant temperature reaches 190°F?

A. Subcritical, with source range count rate below 150 cps.

B. Subcritical, with source range count rate above 150 cps.

C. Exactly critical.

D. Supercritical.

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.03 [3.9/4.0]
QID: P4534

A reactor is critical in the source range during a reactor startup with a core effective delayed neutron fraction of 0.007. The operator then adds positive reactivity to establish a stable 0.5 dpm startup rate.

If the core effective delayed neutron fraction had been 0.005, what would be the approximate stable startup rate after the addition of the same amount of positive reactivity?

A. 0.6 dpm

B. 0.66 dpm

C. 0.7 dpm

D. 0.76 dpm

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.03 [3.9/4.0]
QID: P5025

A nuclear power plant is initially shutdown with a K_{eff} of 0.92 and a stable source range count rate of 200 cps. Then a reactor startup is initiated. All control rod motion is stopped when K_{eff} equals 0.995. The instant that rod motion stops, source range count rate is 1,800 cps.

When source range count rate stabilizes, count rate will be approximately...

A. 1,800 cps

B. 2,400 cps

C. 3,200 cps

D. 3,600 cps

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.03 [3.9/4.0]
QID: P5225 (B5225)

A nuclear power plant was initially shutdown with a stable source range count rate of 30 cps. Using many small additions of positive reactivity, a total of 0.1 %ΔK/K was added to the core and the stable source range count rate is currently 60 cps.

What was the stable source range count rate after only 0.05 %ΔK/K had been added during the above process?

A. 40 cps

B. 45 cps

C. 50 cps

D. 55 cps

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.03 [3.9/4.0]
QID: P5625

A PWR nuclear power plant has been shut down for two weeks and currently has the following stable conditions:

Reactor coolant temperature	=	550°F
Reactor coolant boron concentration	=	800 ppm
Source range count rate	=	32 cps

A reactor coolant boron dilution is commenced. After two hours, with reactor coolant boron concentration stable at 775 ppm, the source range count rate is stable at 48 cps.

Assume the differential boron worth (ΔK/K/ppm) remains constant throughout the dilution. Also assume that reactor coolant temperature remains constant, control rod position does <u>not</u> change, and <u>no</u> reactor protection actuations occur.

If the reactor coolant boron concentration is further reduced to750 ppm, what will be the status of the reactor?

A. Subcritical, with a stable source range count rate of approximately 64 cps.

B. Subcritical, with a stable source range count rate of approximately 96 cps.

C. Critical, with a stable source range count rate of approximately 64 cps.

D. Critical, with a stable source range count rate of approximately 96 cps.

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.03 [3.9/4.0]
QID: P7627 (B7627)

Refer to the drawing that shows a graph of fission rate versus time (see figure below). Both axes have linear scales.

Which one of the following events, initiated at 0 seconds, could cause the reactor response shown on the graph?

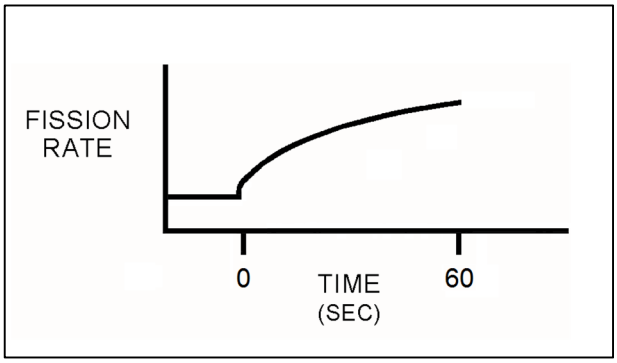
A. A step addition of positive reactivity to a reactor that is initially subcritical in the source range and remains subcritical for the duration of the 60-second interval shown.

B. A step addition of positive reactivity to a reactor that is initially critical in the source range and remains below the point of adding heat for the duration of the 60-second interval shown.

C. A continuous addition of positive reactivity at a constant rate to a reactor that is initially subcritical in the source range and remains subcritical for the duration of the 60-second interval shown.

D. A continuous addition of positive reactivity at a constant rate to a reactor that is initially critical in the source range and remains below the point of adding heat for the duration of the 60-second interval shown.

ANSWER: A.



TOPIC: 192008
KNOWLEDGE: K1.03 [3.9/4.0]
QID: P7668 (B7668)

At the beginning of a reactor startup, K_{eff} was 0.97 and the stable source range count rate was 40 cps. After several incremental control rod withdrawals, the stable source range count rate was 400 cps. The next incremental control rod withdrawal resulted in a stable source range count rate of 600 cps. What is the current K_{eff}?

A. 0.98

B. 0.988

C. 0.998

D. There is <u>not</u> enough information given to calculate the current K_{eff}.

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.04 [3.8/3.8]
QID: P266 (B1566)

During a reactor startup, the operator adds 1.0 %ΔK/K of positive reactivity by withdrawing control rods, thereby increasing the stable source range count rate from 220 cps to 440 cps.

Approximately how much additional positive reactivity is required to raise the stable count rate to 880 cps?

A. 4.0 %ΔK/K

B. 2.0 %ΔK/K

C. 1.0 %ΔK/K

D. 0.5 %ΔK/K

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.04 [3.8/3.8]
QID: P566

A reactor is initially subcritical with a K_{eff} of 0.97 and a stable source range count rate of 500 cps.

Which one of the following will be the approximate final steady-state count rate following a rod withdrawal that adds 1.05 %ΔK/K?

A. 750 cps

B. 1,000 cps

C. 2,000 cps

D. 2,250 cps

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.04 [3.8/3.8]
QID: P666

During a reactor startup, control rods are withdrawn such that K_{eff} increases from 0.98 to 0.99. If the stable source range count rate before the rod withdrawal was 500 cps, which one of the following will be the final stable count rate?

A. 707 cps

B. 1,000 cps

C. 1,500 cps

D. 2,000 cps

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.04 [3.8/3.8]
QID: P1866 (B2266)

As a reactor approaches criticality during a reactor startup, it takes longer to reach an equilibrium neutron level after each control rod withdrawal due to the increased...

A. length of time required to complete a neutron generation.

B. number of neutron generations required to reach a stable neutron level.

C. length of time from neutron birth to absorption.

D. fraction of delayed neutrons being produced.

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.04 [3.8/3.8]
QID: P1867 (B2167)

During a reactor startup, the first reactivity addition caused the stable source range count rate to increase from 20 cps to 40 cps. The second reactivity addition caused the stable count rate to increase from 40 cps to 80 cps. K_{eff} was 0.92 prior to the first reactivity addition.

Which one of the following statements describes the magnitude of the reactivity additions?

A. The first reactivity addition was approximately twice as large as the second.

B. The second reactivity addition was approximately twice as large as the first.

C. The first and second reactivity additions were approximately the same.

D. There is not enough data given to determine the relationship between reactivity values.

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.04 [3.8/3.8]
QID: P1972 (B1067)

With K_{eff} at 0.92 during a reactor startup, the stable source range count rate is noted to be 780 cps. Later in the same startup, the stable count rate is 4,160 cps.

What is the current value of K_{eff}?

A. 0.945

B. 0.950

C. 0.975

D. 0.985

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.04 [3.8/3.8]
QID: P2248 (B2249)

Two reactors are currently shut down with reactor startups in progress. The reactors are identical except that reactor A has a source neutron strength of 100 neutrons per second and reactor B has a source neutron strength of 200 neutrons per second. The control rods are stationary and K_{eff} is 0.98 in both reactors. Core neutron levels have stabilized in both reactors.

Which one of the following lists the core neutron levels (neutrons per second) in reactors A and B?

	Reactor A (n/sec)	Reactor B (n/sec)
A.	5,000	10,000
B.	10,000	20,000
C.	10,000	40,000
D.	20,000	40,000

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.04 [3.8/3.8]
QID: P2265 (B366)

With K_{eff} at 0.95 during a reactor startup, source range indication is stable at 100 cps. After a number of control rods have been withdrawn, source range indication stabilizes at 270 cps. What is the current value of K_{eff}?

A. 0.963

B. 0.972

C. 0.981

D. 0.990

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.04 [3.8/3.8]
QID: P2366 (B2365)

A reactor startup is in progress with a current K_{eff} of 0.95 and a stable source range count rate of 120 cps. Which one of the following stable count rates will occur when K_{eff} becomes 0.97?

A. 200 cps

B. 245 cps

C. 300 cps

D. 375 cps

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.04 [3.8/3.8]
QID: P2468 (B1766)

A reactor startup is in progress with a current K_{eff} of 0.95 and a stable source range count rate of 150 cps. Which one of the following stable count rates will occur when K_{eff} becomes 0.98?

A. 210 cps

B. 245 cps

C. 300 cps

D. 375 cps

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.04 [3.8/3.8]
QID: P2766 (B2765)

With K_{eff} at 0.95 during a reactor startup, source range indication is stable at 120 cps. After a period of control rod withdrawal, source range indication stabilizes at 600 cps.

What is the current value of K_{eff}?

A. 0.96

B. 0.97

C. 0.98

D. 0.99

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.04 [3.8/3.8]
QID: P3848 (B3849)

A reactor is shutdown with a K_{eff} of 0.8. The source range count rate is stable at 800 cps. What percentage of the core neutron population is being contributed directly by neutron sources other than neutron-induced fission?

A. 10 percent

B. 20 percent

C. 80 percent

D. 100 percent

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.04 [3.8/3.8]
QID: P4734 (B7638)

During a reactor startup, positive reactivity addition X caused the stable source range count rate to increase from 20 cps to 40 cps. Later in the startup, after several other additions of positive reactivity, positive reactivity addition Y caused the stable source range count rate to increase from 320 cps to 640 cps.

Which one of the following statements describes how the magnitudes of the two positive reactivity additions (X and Y) compare?

A. Reactivity addition X was several times greater in magnitude than reactivity addition Y.

B. Reactivity addition X was several times smaller in magnitude than reactivity addition Y.

C. Reactivity additions X and Y were about equal in magnitude.

D. There is not enough information given to determine the relationship between the reactivity additions.

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.04 [3.8/3.8]
QID: P6133 (B6134)

A subcritical reactor has a stable source range count rate of 2.0 x 10^5 cps with a K_{eff} of 0.98. Positive reactivity is added to the core until a stable count rate of 5.0 x 10^5 cps is achieved. What is the current value of K_{eff}?

A. 0.984

B. 0.988

C. 0.992

D. 0.996

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.04 [3.8/3.8]
QID: P7628 (B7628)

A reactor is shutdown with a K_{eff} of 0.8. The source range count rate is stable at 800 cps. What percentage of the core neutron population is being contributed directly by neutron-induced fission?

A. 10 percent

B. 20 percent

C. 80 percent

D. 100 percent

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.04 [3.8/3.8]
QID: P7698 (B7698)

A reactor is shutdown with a K_{eff} of 0.96. The source range count rate is stable at 480 cps. What percentage of the core neutron population is being contributed directly by neutron sources other than neutron-induced fission?

A. 4 percent

B. 50 percent

C. 96 percent

D. 100 percent

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.05 [3.8/3.9]
QID: P267 (B1365)

As criticality is approached during a reactor startup, equal insertions of positive reactivity result in a _____ numerical change in the stable source range count rate and a _____ time to reach each new stable count rate.

A. larger; longer

B. larger; shorter

C. smaller; longer

D. smaller; shorter

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.05 [3.8/3.9]
QID: P365 (B365)

A reactor startup is in progress with a stable source range count rate and the reactor is near criticality. Which one of the following statements describes count rate characteristics during and after a 5-second control rod withdrawal? (Assume the reactor remains subcritical.)

A. There will be no change in count rate until criticality is achieved.

B. The count rate will rapidly increase (prompt jump) to a stable higher value.

C. The count rate will rapidly increase (prompt jump), then gradually increase and stabilize at a higher value.

D. The count rate will rapidly increase (prompt jump), then gradually decrease and stabilize at the original value.

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.05 [3.8/3.9]
QID: P1265 (B1967)

During an initial fuel load, the subcritical multiplication factor increases from 1.0 to 4.0 as the first 100 fuel assemblies are loaded. What is K_{eff} after the first 100 fuel assemblies are loaded?

A. 0.25

B. 0.5

C. 0.75

D. 1.0

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.05 [3.8/3.9]
QID: P1770 (B1665)

Refer to the drawing of three 1/M plots labeled A, B, and C (see figure below). Each axis has linear units.

The least conservative approach to criticality is represented by plot _____; which could possibly result from recording source range count rates at _____ time intervals after incremental fuel loading steps as compared to the conditions represented by the other plots.

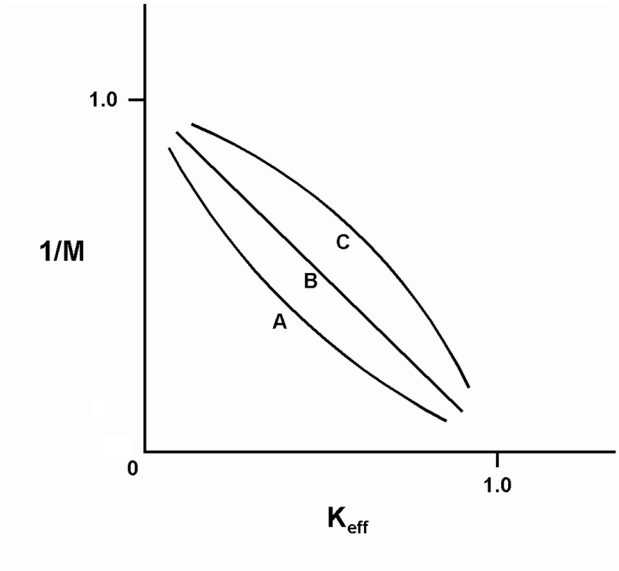
A. A; shorter

B. A; longer

C. C; shorter

D. C; longer

ANSWER: C.



TOPIC: 192008
KNOWLEDGE: K1.05 [3.8/3.9]
QID: P3567

A reactor startup is in progress for a reactor that is in the middle of a fuel cycle. The reactor coolant system is at normal operating temperature and pressure. The main steam isolation valves are open and the main turbine bypass (also called steam dump) valves are closed. The reactor is near criticality.

Reactor startup rate (SUR) is stable at zero when, suddenly, a turbine bypass valve fails open and remains stuck open, dumping steam to the main condenser. The operator immediately ensures no control rod motion is occurring and takes no further action. Assume the steam generator water levels remain stable, and no automatic reactor protective actions occur.

As a result of the valve failure, SUR will initially become _____; and reactor power will stabilize _____ the point of adding heat.

A. positive; at

B. positive; above

C. negative; at

D. negative; above

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.05 [3.8/3.9]
QID: P3665 (B3665)

Refer to the drawing of a 1/M plot with curves A and B (see figure below). Each axis has linear units.

Curve A would result if each fuel assembly loaded during the early stages of the refueling caused a relatively _____ fractional change in source range count rate compared to the later stages of the refueling; curve B would result if each fuel assembly contained equal _____.

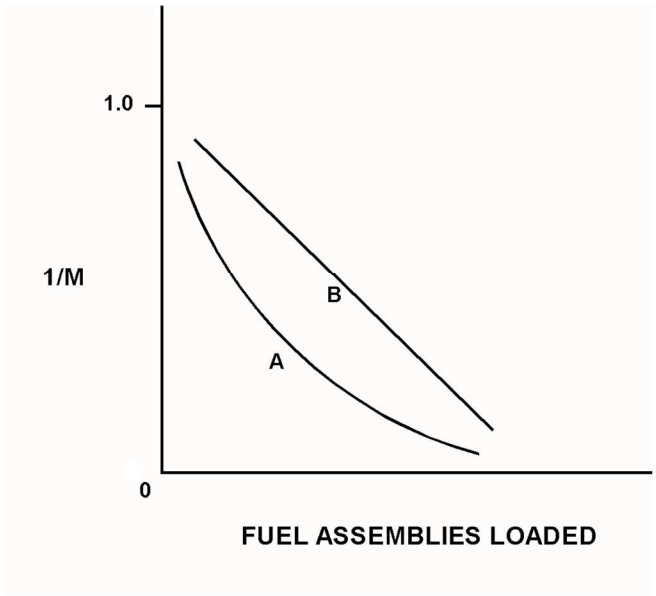
A. small; fuel enrichment

B. small; reactivity

C. large; fuel enrichment

D. large; reactivity

ANSWER: D.



TOPIC: 192008
KNOWLEDGE: K1.05 [3.8/3.9]
QID: P5733 (B5733)

During an initial fuel load, the subcritical multiplication factor increases from 1.0 to 8.0. What is the current value of K_{eff}?

A. 0.125

B. 0.5

C. 0.75

D. 0.875

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.05 [3.8/3.9]
QID: P6034 (B6033)

Refer to the drawing of a 1/M plot with curves A and B (see figure below). Each axis has linear units.

Curve A would result if each fuel assembly loaded during the early stages of core refueling caused a relatively _____ fractional change in stable source range count rate compared to the later stages of the refueling; curve B would result if each fuel assembly contained equal _____.

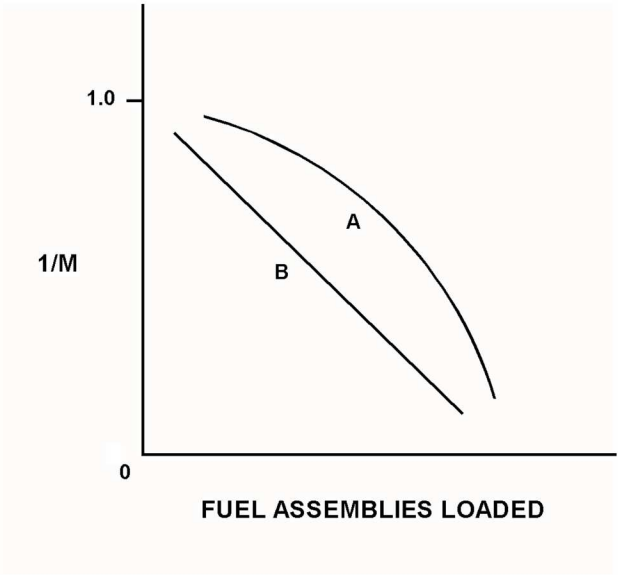
A. small; fuel enrichment

B. small; reactivity

C. large; fuel enrichment

D. large; reactivity

ANSWER: B.



TOPIC: 192008
KNOWLEDGE: K1.06 [2.9/3.1]
QID: P466

During a reactor startup, as K_{eff} increases toward 1.0 the value of 1/M...

A. decreases toward zero.

B. decreases toward 1.0.

C. increases toward infinity.

D. increases toward 1.0.

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.06 [2.9/3.1]
QID: P969

The following data was obtained under stable conditions during a reactor startup:

Control Rod Position (units withdrawn)	Source Range Count Rate (cps)
0	20
10	25
15	28
20	33
25	40
30	50

Assuming uniform differential rod worth, at what approximate control rod position will criticality occur?

A. 66 to 75 units withdrawn

B. 56 to 65 units withdrawn

C. 46 to 55 units withdrawn

D. 35 to 45 units withdrawn

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.06 [2.9/3.1]
QID: P1167 (B2767)

The following data was obtained under stable conditions during a reactor startup:

Control Rod Position (units withdrawn)	Source Range Count Rate (cps)
0	180
10	210
15	250
20	300
25	360
30	420

Assuming uniform differential rod worth, at what approximate control rod position will criticality occur?

A. 35 to 45 units withdrawn

B. 46 to 55 units withdrawn

C. 56 to 65 units withdrawn

D. 66 to 75 units withdrawn

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.06 [2.9/3.1]
QID: P1667 (B1567)

The following data was obtained under stable conditions during a reactor startup:

Control Rod Position (units withdrawn)	Source Range Count Rate (cps)
0	180
5	200
10	225
15	257
20	300
25	360
30	450

Assuming uniform differential rod worth, at what approximate control rod position will criticality occur?

A. 40 units withdrawn

B. 50 units withdrawn

C. 60 units withdrawn

D. 70 units withdrawn

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.06 [2.9/3.1]
QID: P1966 (B1767)

The following data was obtained under stable conditions during a reactor startup:

Control Rod Position (units withdrawn)	Source Range Count Rate (cps)
10	360
15	400
20	450
25	514
30	600
35	720
40	900

Assuming uniform differential rod worth, at what approximate control rod position will criticality occur?

A. 50 units withdrawn

B. 60 units withdrawn

C. 70 units withdrawn

D. 80 units withdrawn

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.07 [3.5/3.6]
QID: P67

An estimated critical rod position has been calculated for criticality to occur 4 hours after a reactor trip from steady-state 100 percent power. The actual critical rod position will be lower than the estimated critical rod position if...

A. the startup is delayed until 8 hours after the trip.

B. the steam dump pressure setpoint is lowered by 100 psi prior to reactor startup.

C. actual boron concentration is 10 ppm higher than the assumed boron concentration.

D. one control rod remains fully inserted during the approach to criticality.

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.07 [3.5/3.6]
QID: P367

Which one of the following is not required to determine the estimated critical boron concentration for a reactor startup to be performed 48 hours following an inadvertent reactor trip?

A. Reactor power level just prior to the trip.

B. Steam generator levels just prior to the trip.

C. Xenon-135 reactivity in the core just prior to the trip.

D. Samarium-149 reactivity in the core just prior to the trip.

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.07 [3.5/3.6]
QID: P467

An estimated critical rod position (ECP) has been calculated for criticality to occur 6 hours after a reactor trip from 60 days of operation at 100 percent power. Which one of the following events or conditions will result in the actual critical rod position being lower than the ECP?

A. The startup is delayed for approximately 2 hours.

B. Steam generator feedwater addition rate is reduced by 5 percent just prior to criticality.

C. Steam generator pressures are decreased by 100 psi just prior to criticality.

D. A new boron sample shows a current boron concentration 20 ppm higher than that used in the ECP calculation.

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.07 [3.5/3.6]
QID: P765

Which one of the following conditions will result in criticality occurring at a rod position that is lower than the estimated control rod position?

A. Adjusting reactor coolant system boron concentration to 50 ppm lower than assumed for startup calculations.

B. A malfunction resulting in control rod speed being lower than normal speed.

C. Delaying the time of startup from 10 days to 14 days following a trip from 100 percent power equilibrium conditions.

D. Misadjusting the steam dump (turbine bypass) controller such that steam pressure is maintained 50 psig higher than the required no-load setting.

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.07 [3.5/3.6]
QID: P970

An estimated critical rod position (ECP) has been calculated for criticality to occur 15 hours after a reactor trip from long-term 100 percent power operation. Which one of the following conditions would cause the actual critical rod position to be higher than the ECP?

A. A 90 percent value for reactor power was used for power defect determination in the ECP calculation.

B. Reactor criticality is achieved approximately 2 hours earlier than anticipated.

C. Steam generator pressures are decreased by 100 psi just prior to criticality.

D. Current boron concentration is 10 ppm lower than the value used in the ECP calculation.

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.07 [3.5/3.6]
QID: P1266

A reactor is subcritical with a startup in progress. Which one of the following conditions will result in a critical rod position that is lower than the estimated critical rod position?

A. A malfunction resulting in control rod speed being faster than normal speed.

B. A malfunction resulting in control rod speed being slower than normal speed.

C. Delaying the time of startup from 3 hours to 5 hours following a trip from 100 percent power equilibrium conditions.

D. An inadvertent dilution of reactor coolant system boron concentration.

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.07 [3.5/3.6]
QID: P1365

Control rods are being withdrawn during a reactor startup. Which one of the following will result in reactor criticality at a rod position that is higher than the estimated critical rod position?

A. Steam generator pressure increases by 50 psia.

B. Steam generator level increases by 10 percent.

C. Pressurizer pressure increases by 50 psia.

D. Pressurizer level increases by 10 percent.

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.07 [3.5/3.6]
QID: P1565

A reactor startup is in progress following a reactor trip from steady-state 100 percent power. Which one of the following conditions will result in criticality occurring at a rod position that is higher than the estimated critical rod position?

A. Misadjusting the steam dump (turbine bypass) controller such that steam generator pressure is maintained 50 psig higher than the required no-load setting.

B. Adjusting reactor coolant system boron concentration to 50 ppm lower than assumed for startup calculations.

C. A malfunction resulting in control rod speed being 10 percent slower than normal speed.

D. Delaying the time of startup from 10 days to 14 days following the trip.

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.07 [3.5/3.6]
QID: P1666

An estimated critical rod position (ECP) has been calculated for criticality to occur 15 hours after a reactor trip that ended three months of operation at 100 percent power.

Which one of the following will result in criticality occurring at a rod position that is lower than the calculated ECP?

A. Adjusting reactor coolant system boron concentration to 50 ppm higher than assumed for startup calculations.

B. A malfunction resulting in control rod speed being slower than normal speed.

C. Moving the time of startup from 15 hours to 12 hours following the trip.

D. Using a pretrip reactor power of 90 percent to determine power defect.

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.07 [3.5/3.6]
QID: P1765

A reactor trip has occurred from 100 percent reactor power and equilibrium xenon-135 conditions near the middle of a fuel cycle. An estimated critical rod position (ECP) has been calculated using the following assumptions:

- Criticality occurs 24 hours after the trip.
- Reactor coolant temperature is 550°F.
- Reactor coolant boron concentration is 400 ppm.

Which one of the following will result in criticality occurring at a rod position that is <u>higher</u> than the calculated ECP?

A. Decreasing reactor coolant system boron concentration to 350 ppm.

B. A malfunction resulting in control rod speed being 20 percent higher than normal speed.

C. Moving the time of criticality to 30 hours after the trip.

D. Misadjusting the steam dump (turbine bypass) controller such that reactor coolant temperature is being maintained at 553°F.

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.07 [3.5/3.6]
QID: P7335

A reactor trip has occurred from 100 percent power and equilibrium xenon-135 conditions near the middle of a fuel cycle. An estimated critical rod position (ECP) has been calculated for the subsequent reactor startup using the following assumptions:

- Criticality occurs 24 hours after the trip.
- Reactor coolant temperature is 550°F.
- Reactor coolant boron concentration is 400 ppm.

Which one of the following will result in criticality occurring at a control rod position that is lower than the calculated ECP?

A. Moving the time of criticality to 18 hours after the trip.

B. Decreasing reactor coolant system boron concentration to 350 ppm.

C. A malfunction resulting in control rod speed being 20 percent lower than normal speed.

D. Misadjusting the steam dump (turbine bypass) controller such that reactor coolant temperature is being maintained at 553°F.

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.09 [3.2/3.3]
QID: P68 (B123)

With K_{eff} at 0.985, how much reactivity must be added to make a reactor exactly critical?

A. 1.48 %ΔK/K

B. 1.50 %ΔK/K

C. 1.52 %ΔK/K

D. 1.54 %ΔK/K

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.09 [3.2/3.3]
QID: P469

A reactor is subcritical by 1.0 %ΔK/K when the operator dilutes the reactor coolant system boron concentration by 30 ppm. If differential boron worth is -0.025 %ΔK/K/ppm, the reactor is currently...

A. subcritical.

B. critical.

C. supercritical.

D. prompt critical.

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.09 [3.2/3.3]
QID: P2267 (B867)

When a reactor is critical, reactivity is...

A. infinity.

B. undefined.

C. 0.0 ΔK/K.

D. 1.0 ΔK/K.

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.10 [3.3/3.4]
QID: P69

During a reactor startup, if the startup rate is constant and positive without any further reactivity addition, then the reactor is...

A. critical.

B. supercritical.

C. subcritical.

D. prompt critical.

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.10 [3.3/3.4]
QID: P125

A reactor is initially critical at 10,000 cps in the source range when a steam generator atmospheric relief valve fails open. Assume end of fuel cycle conditions, no reactor trip, and no operator actions are taken.

When the reactor stabilizes, the average reactor coolant temperature (T_{ave}) will be _____ than the initial T_{ave} and reactor power will be _____ the point of adding heat.

A. greater; at

B. greater; greater than

C. less; at

D. less; greater than

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.10 [3.3/3.4]
QID: P136

A reactor startup is being performed following a one-month shutdown period. If the reactor is taken critical and then stabilized at 10,000 cps in the source range, over the next 10 minutes the count rate will...

A. remain constant.

B. decrease linearly.

C. decrease geometrically.

D. decrease exponentially.

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.10 [3.3/3.4]
QID: P1870

A reactor startup is in progress following a one-month shutdown. Upon reaching criticality, the operator establishes a positive 0.5 dpm startup rate and stops control rod motion.

After an additional five minutes, reactor power will be _____ and startup rate will be _____. (Assume reactor power remains below the point of adding heat.)

A. constant; constant

B. constant; increasing

C. increasing; constant

D. increasing; increasing

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.10 [3.3/3.4]
QID: P2667

A reactor is critical at 1.0 x 10^{-6} percent power. Control rods are withdrawn for 5 seconds and then stopped, resulting in a stable startup rate (SUR) of positive 0.2 dpm.

If the control rods had been inserted for 5 seconds instead of withdrawn, the stable SUR would have been: (Assume equal absolute values of reactivity are added in both cases.)

A. more negative than -0.2 dpm because, compared to reactor power increases, reactor power decreases result in smaller delayed neutron fractions.

B. more negative than -0.2 dpm because, compared to reactor power increases, reactor power decreases are less limited by delayed neutrons.

C. less negative than -0.2 dpm because, compared to reactor power increases, reactor power decreases result in larger delayed neutron fractions.

D. less negative than -0.2 dpm because, compared to reactor power increases, reactor power decreases are more limited by delayed neutrons.

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.10 [3.3/3.4]
QID: P3467 (B3451)

A reactor is critical well below the point of adding heat during a plant startup. A small amount of positive reactivity is then added to the core, and a stable positive startup rate (SUR) is established.

With the stable positive SUR, the following power levels are observed:

Time	Power Level
0 sec	3.16×10^{-7} percent
90 sec	1.0×10^{-5} percent

Which one of the following will be the reactor power level at time = 120 seconds?

A. 3.16×10^{-5} percent

B. 5.0×10^{-5} percent

C. 6.32×10^{-5} percent

D. 1.0×10^{-4} percent

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.10 [3.3/3.4]
QID: P5334 (B5334)

Given:

- Reactors A and B are identical except that reactor A has an effective delayed neutron fraction of 0.0068 and reactor B has an effective delayed neutron fraction of 0.0052.
- Reactor A has a stable period of 45 seconds and reactor B has a stable period of 42 seconds.
- Both reactors are initially operating at 1.0×10^{-8} percent power.

The reactor that is supercritical by the greater amount of positive reactivity is reactor _____; and the first reactor to reach 1.0×10^{-1} percent power will be reactor _____.

A A; A

B. A; B

C. B; A

D. B; B

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.10 [3.3/3.4]
QID: P5535 (B5534)

A reactor is currently operating in the source range with a stable positive 90-second period. The core effective delayed neutron fraction ($\bar{\beta}_{eff}$) is 0.006. How much additional positive reactivity is needed to establish a stable positive 60-second period?

A. 0.026 %ΔK/K

B. 0.033 %ΔK/K

C. 0.067 %ΔK/K

D. 0.086 %ΔK/K

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.10 [3.3/3.4]
QID: P6435 (B6434)

A reactor is critical near the end of a fuel cycle with power level stable at 1.0×10^{-10} percent. Which one of the following is the smallest listed amount of positive reactivity that is capable of increasing reactor power level to the point of adding heat?

A. 0.001 %ΔK/K

B. 0.003 %ΔK/K

C. 0.005 %ΔK/K

D. 0.007 %ΔK/K

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.10 [3.3/3.4]
QID: P6734 (B6734)

Reactors A and B are identical except that reactor A has an effective delayed neutron fraction of 0.007 and reactor B has an effective delayed neutron fraction of 0.006. Both reactors are initially critical at 1.0×10^{-8} percent of rated thermal power when +0.1 %ΔK/K is simultaneously added to both reactors.

Five minutes after the reactivity additions, reactor _____ will be at the higher power level; and reactor _____ will have the higher startup rate.

A. A; A

B. A; B

C. B; A

D. B; B

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.10 [3.3/3.4]
QID: P7688 (B7688)

Given:

- Reactors A and B are identical except that reactor A has an effective delayed neutron fraction of 0.0055 and reactor B has an effective delayed neutron fraction of 0.0052.
- Reactor A has a stable period of 42 seconds and reactor B has a stable period of 45 seconds.
- Both reactors are initially operating at 1.0×10^{-8} percent power.

The reactor that is supercritical by the greater amount of positive reactivity is reactor _____; and the first reactor to reach 1.0×10^{-1} percent power will be reactor _____.

A. A; A

B. A; B

C. B; A

D. B; B

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.11 [3.8/3.8]
QID: P868

Which one of the following indicates that a reactor has achieved criticality during a normal reactor startup?

A. Constant positive startup rate during rod withdrawal.

B. Increasing positive startup rate during rod withdrawal.

C. Constant positive startup rate with no rod motion.

D. Increasing positive startup rate with no rod motion.

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.11 [3.8/3.8]
QID: P2968

A reactor startup is in progress. Control rod withdrawal was stopped several minutes ago to assess criticality. Which one of the following is a combination of indications that together support a declaration that the reactor has reached criticality?

A. Startup rate is stable at 0.0 dpm; source range count rate is stable.

B. Startup rate is stable at 0.2 dpm; source range count rate is stable.

C. Startup rate is stable at 0.0 dpm; source range count rate is slowly increasing.

D. Startup rate is stable at 0.2 dpm; source range count rate is slowly increasing.

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.12 [3.5/3.6]
QID: P767

A reactor has just achieved criticality at 1.0×10^{-8} percent reactor power during a reactor startup from xenon-free conditions. The operator establishes a 0.5 dpm startup rate to increase power. Over a period of 10 minutes, startup rate decreases to zero and then becomes increasingly negative.

Which one of the following is a possible cause for these indications?

A. Fuel depletion.

B. Burnable poison burnout.

C. Reactor power reaching the point of adding heat.

D. Inadvertent boration of the reactor coolant system.

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.12 [3.5/3.6]
QID: P1366

During a reactor startup from a xenon-free condition, and after recording critical data, the operator establishes a positive 0.4 dpm startup rate to increase power. Within 10 minutes, and prior to reaching the point of adding heat, reactor power stops increasing and begins to slowly decrease.

Which one of the following changes could have caused this behavior?

A. Inadvertent boration of the RCS.

B. Xenon buildup in the core.

C. Gradual cooling of the RCS.

D. Fission-induced heating of the fuel.

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.13 [3.4/3.6]
QID: P670 (B670)

After taking critical data during a reactor startup, the operator establishes a positive 1.0 dpm startup rate to increase power to the point of adding heat (POAH). Which one of the following is the approximate amount of reactivity needed to stabilize reactor power at the POAH? (Assume that $\bar{\beta}_{eff}$ = 0.00579.)

A. -0.16 %ΔK/K

B. -0.19 %ΔK/K

C. -0.23 %ΔK/K

D. -0.29 %ΔK/K

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.13 [3.4/3.6]
QID: P768

The point of adding heat can be defined as the power level at which the reactor is producing enough heat...

A. for the fuel temperature coefficient to produce a positive reactivity feedback.

B. for the void coefficient to produce a negative reactivity feedback.

C. to cause a measurable temperature increase in the fuel and coolant.

D. to support main turbine operations.

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.13 [3.4/3.6]
QID: P2370 (B2369)

After taking critical data during a reactor startup, the operator establishes a positive 0.54 dpm startup rate to increase reactor power to the point of adding heat (POAH). Which one of the following is the approximate amount of reactivity needed to stabilize power at the POAH? (Assume $\bar{\beta}_{eff} = 0.00579$.)

A. +0.10 %ΔK/K

B. +0.12 %ΔK/K

C. -0.10 %ΔK/K

D. -0.12 %ΔK/K

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.13 [3.4/3.6]
QID: P2470

A reactor startup is in progress following a one-month shutdown. Upon reaching criticality, the operator establishes a stable positive 1.0 dpm startup rate and stops rod motion.

After an additional 30 seconds, reactor power will be _____ and startup rate will be _____. (Assume reactor power remains below the point of adding heat.)

A. increasing; increasing

B. increasing; constant

C. constant; increasing

D. constant; constant

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.13 [3.4/3.6]
QID: P2668

A reactor is critical during a xenon-free reactor startup. Reactor power is increasing in the intermediate range with a stable 0.5 dpm startup rate (SUR).

Assuming <u>no</u> operator action is taken that affects reactivity, SUR will remain constant until...

A. reactor coolant temperature begins to increase, then SUR will increase.

B. core xenon-135 production becomes significant, then SUR will increase.

C. delayed neutron production rate exceeds prompt neutron production rate, then SUR will decrease.

D. fuel temperature begins to increase, then SUR will decrease.

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.13 [3.4/3.6]
QID: P3068 (B3068)

After taking critical data during a reactor startup, the operator establishes a positive 0.75 dpm startup rate to increase power to the point of adding heat (POAH). Which one of the following is the approximate amount of reactivity needed to stabilize reactor power at the POAH? (Assume $\bar{\beta}_{eff}$ = 0.0066.)

A. -0.10 %ΔK/K

B. -0.12 %ΔK/K

C. -0.15 %ΔK/K

D. -0.28 %ΔK/K

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.13 [3.4/3.6]
QID: P3935 (B3934)

After taking critical data during a reactor startup, the operator establishes a positive 0.52 dpm startup rate to increase power to the point of adding heat (POAH). Which one of the following is the approximate amount of reactivity needed to stabilize reactor power at the POAH? (Assume $\bar{\beta}_{eff}$ = 0.006.)

A. -0.01 %ΔK/K

B. -0.06 %ΔK/K

C. -0.10 %ΔK/K

D. -0.60 %ΔK/K

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.14 [3.1/3.1]
QID: P568

During a xenon-free reactor startup, critical data was inadvertently taken two decades below the required intermediate range (IR) power level. The critical data was taken again at the proper IR power level with the same reactor coolant temperature and boron concentration.

The critical rod position taken at the proper IR power level is _____ the critical rod position taken two decades below the proper IR power level.

A. unrelated to

B. greater than

C. the same as

D. less than

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.14 [3.1/3.1]
QID: P669

During a xenon-free reactor startup, critical data was inadvertently taken one decade above the required intermediate range (IR) power level. The critical data was taken again at the proper IR power level with the same reactor coolant temperature and boron concentration.

The critical rod position taken at the proper IR power level is _____ the critical rod position taken one decade above the proper IR power level.

A. less than

B. the same as

C. greater than

D. unrelated to

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.14 [3.1/3.1]
QID: P972

A reactor is critical several decades below the point of adding heat (POAH) when a small amount of positive reactivity is added to the core. If the exact same amount of negative reactivity is then added prior to reaching the POAH, reactor power will stabilize...

A. higher than the initial power level but below the POAH.

B. lower than the initial power level.

C. at the initial power level.

D. at the POAH.

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.14 [3.1/3.1]
QID: P1267

A reactor has just achieved criticality during a xenon-free reactor startup and power is being increased to take critical data. Instead of stabilizing power at 1.0×10^{-5} percent per the startup procedure, the operator inadvertently stabilizes power at 1.0×10^{-4} percent.

Assuming reactor coolant system (RCS) temperature and RCS boron concentration do not change, the critical rod height at 1.0×10^{-4} percent power will be _____ the critical rod height at 1.0×10^{-5} percent power.

A. less than

B. equal to

C. greater than

D. independent of

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.14 [3.1/3.1]
QID: P1268

A reactor is exactly critical two decades below the point of adding heat when -0.01 %ΔK/K of reactivity is added. If +0.01 %ΔK/K is added 2 minutes later, reactor power will stabilize at...

A. the point of adding heat.

B. the initial power level.

C. somewhat lower than the initial power level.

D. an equilibrium subcritical power level.

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.14 [3.1/3.1]
QID: P1669

A reactor is initially critical at 1.0×10^{-5} percent power near the middle of a fuel cycle with manual rod control when a steam generator relief valve fails open. Assume <u>no</u> operator actions are taken and the reactor does <u>not</u> trip.

When the reactor stabilizes, average reactor coolant temperature will be _____ the initial reactor coolant temperature; and reactor power will be _____ the point of adding heat.

A. equal to; greater than

B. equal to; equal to

C. less than; greater than

D. less than; equal to

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.14 [3.1/3.1]
QID: P2269

A reactor is critical at the point of adding heat (POAH) when a small amount of negative reactivity is added. If the same amount of positive reactivity is added approximately 5 minutes later, reactor power will...

A. increase and stabilize at the POAH.

B. quickly stabilize at a power level below the POAH.

C. continue to decrease with a -1/3 dpm startup rate until an equilibrium shutdown neutron level is reached.

D. continue to decrease with an unknown startup rate until an equilibrium shutdown neutron level is reached.

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.14 [3.1/3.1]
QID: P2568 (B2568)

A reactor was operating at 1.0×10^{-3} percent power with a positive 0.6 dpm startup rate when an amount of negative reactivity was inserted that caused reactor power to decrease with a negative 0.4 dpm startup rate.

If an equal amount of positive reactivity is added 5 minutes later, reactor power will...

A. increase and stabilize at the point of adding heat.

B. increase and stabilize at 1.0×10^{-3} percent power.

C. continue to decrease with a negative 0.4 dpm startup rate until an equilibrium shutdown neutron level is reached.

D. continue to decrease with an unknown startup rate until an equilibrium shutdown neutron level is reached.

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.14 [3.1/3.1]
QID: P3668

A reactor is slightly supercritical during a reactor startup. A short control rod withdrawal is performed to establish the desired positive startup rate. Assume that the reactor remains slightly supercritical after the control rod withdrawal, and that reactor power remains well below the point of adding heat.

Immediately after the control rod withdrawal is stopped, the startup rate will initially decrease and then...

A. stabilize at a positive value.

B. turn and slowly increase.

C. stabilize at zero.

D. continue to slowly decrease.

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.14 [3.1/3.1]
QID: P4033

Refer to the drawing that shows two graphs (see figure below). The axes on each graph have linear scales.

A reactor is initially critical in the source range. At 0 seconds, a constant rate addition of positive reactivity commences. Assume that reactor power remains below the point of adding heat for the entire time interval shown.

The general response of startup rate to this event is shown on graph _____; and the general response of reactor power to this event is shown on graph _____. (Note: Either graph may be chosen once, twice, or not at all.)

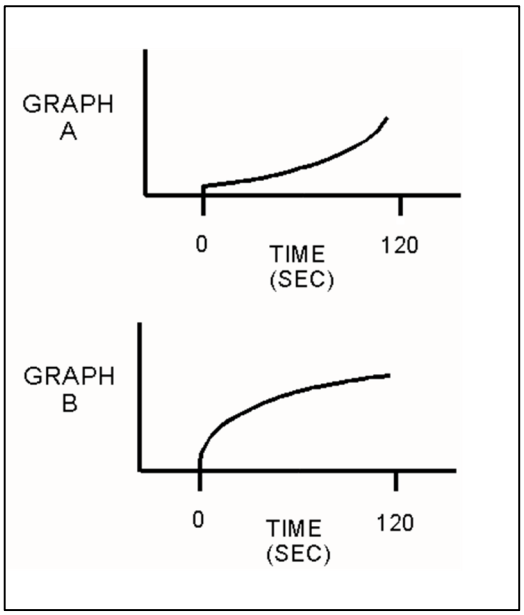
A. A; A

B. A; B

C. B; A

D. B; B

ANSWER: A.



TOPIC: 192008
KNOWLEDGE: K1.14 [3.1/3.1]
QID: P4434

Refer to the drawing that shows a graph of startup rate versus time (see figure below). Both axes have linear scales.

Which one of the following events, initiated at 0 seconds, would cause the reactor response shown on the graph?

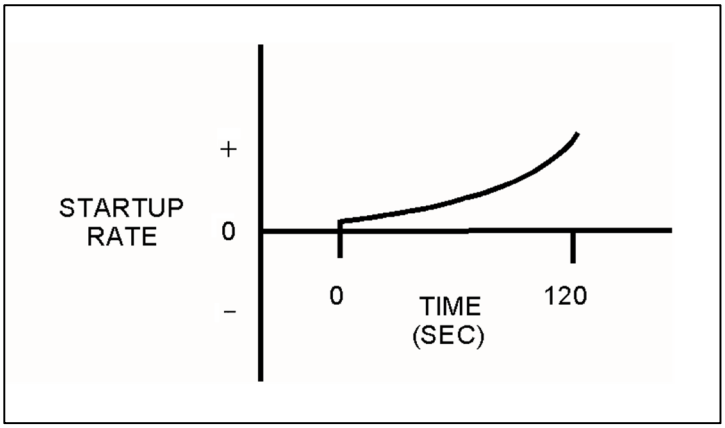
A. A step addition of positive reactivity to a reactor that is initially stable in the power range and remains in the power range for the duration of the 120-second interval shown.

B. A constant rate of positive reactivity addition to a reactor that is initially stable in the power range and remains in the power range for the duration of the 120-second interval shown.

C. A step addition of positive reactivity to a reactor that is initially critical in the source range and remains below the point of adding heat for the duration of the 120-second interval shown.

D. A constant rate of positive reactivity addition to a reactor that is initially critical in the source range and remains below the point of adding heat for the duration of the 120-second interval shown.

ANSWER: D.



TOPIC: 192008
KNOWLEDGE: K1.14 [3.1/3.1]
QID: P4636

During a reactor startup, source range count rate is observed to double every 30 seconds. Which one of the following is the approximate startup rate?

A. 0.6 dpm

B. 0.9 dpm

C. 1.4 dpm

D. 2.0 dpm

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.14 [3.1/3.1]
QID: P5834 (B5833)

Refer to the drawing that shows a graph of fission rate versus time (see figure below). Both axes have linear scales.

Which one of the following events, initiated at 0 seconds, would cause the reactor response shown on the graph?

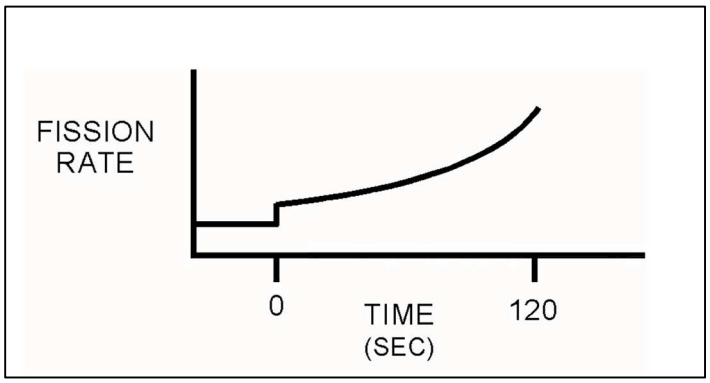
A. A step addition of positive reactivity to a reactor that is initially subcritical in the source range and remains subcritical for the duration of the 120-second interval shown.

B. A step addition of positive reactivity to a reactor that is initially critical in the source range and remains below the point of adding heat for the duration of the 120-second interval shown.

C. A step addition of positive reactivity to a reactor that is initially critical in the power range and remains in the power range for the duration of the 120-second interval shown.

D. A constant rate of positive reactivity addition to a reactor that is initially critical in the power range and remains in the power range for the duration of the 120-second interval shown.

ANSWER: B.



TOPIC: 192008
KNOWLEDGE: K1.14 [3.1/3.1]
QID: P6335

Refer to the drawing that shows a graph of startup rate versus time (see figure below) for a reactor. Both axes have linear scales.

Which one of the following events, initiated at 0 seconds, would cause the startup rate response shown on the graph?

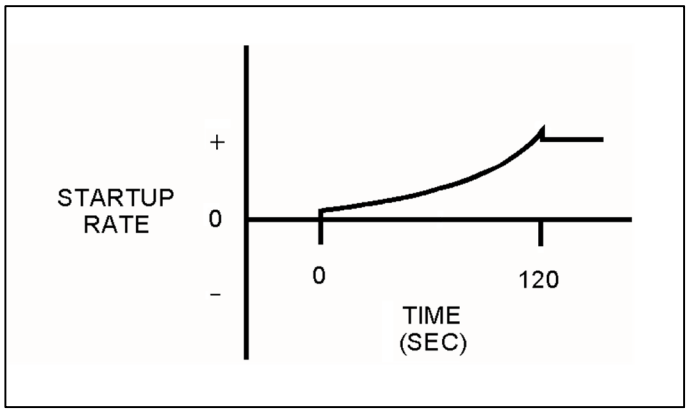
A. A step addition of positive reactivity to a reactor that is initially critical in the source range. Reactor power enters the power range at 120 seconds.

B. A step addition of positive reactivity to a reactor that is initially stable in the power range. A step addition of negative reactivity is inserted at 120 seconds.

C. A controlled constant rate of positive reactivity addition to a reactor that is initially critical in the source range and remains below the point of adding heat. The positive reactivity addition ends at 120 seconds.

D. A controlled constant rate of positive reactivity addition to a reactor that is initially stable in the power range and remains in the power range. The positive reactivity addition ends at 120 seconds.

ANSWER: C.



TOPIC: 192008
KNOWLEDGE: K1.15 [3.4/3.4]
QID: P569

A reactor is critical below the point of adding heat (POAH). The operator adds enough reactivity to attain a startup rate of 0.5 decades per minute. Which one of the following will decrease first when the reactor reaches the POAH?

A. Pressurizer level

B. Reactor coolant temperature

C. Reactor power

D. Startup rate

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.17 [3.3/3.4]
QID: P70

For a slightly supercritical reactor operating below the point of adding heat (POAH), what reactivity effects are associated with reaching the POAH?

A. There are no reactivity effects.

B. An increase in fuel temperature will begin to create a positive reactivity effect.

C. A decrease in fuel temperature will begin to create a negative reactivity effect.

D. An increase in fuel temperature will begin to create a negative reactivity effect.

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.17 [3.3/3.4]
QID: P471

A reactor is operating at a stable power level just above the point of adding heat. To raise reactor power to a higher stable power level, the operator must increase...

A. steam demand.

B. steam generator water levels.

C. average reactor coolant temperature.

D. reactor coolant system boron concentration.

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.17 [3.3/3.4]
QID: P1070

A reactor is critical at a stable power level below the point of adding heat (POAH) when a small amount of positive reactivity is added. Which one of the following reactivity coefficient(s) will stabilize reactor power at the POAH?

A. Moderator temperature only

B. Fuel temperature only

C. Moderator temperature and fuel temperature

D. Fuel temperature and moderator voids

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.17 [3.3/3.4]
QID: P1172

A reactor startup is in progress near the end of a fuel cycle. Reactor power is 5 x 10^{-2} percent and increasing slowly with a stable 0.3 dpm startup rate. Assuming no operator action, no reactor trip, and no steam release, what will reactor power be after 10 minutes?

A. 100 percent

B. 50 percent

C. 10 percent

D. 1 percent (point of adding heat)

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.17 [3.3/3.4]
QID: P1367

A reactor startup is in progress near the end of a fuel cycle. Reactor power is 5 x 10^{-3} percent and increasing slowly with a stable 0.3 dpm startup rate. Assuming no operator action, no reactor trip, and no steam release, what will reactor power be after 10 minutes?

A. Below the point of adding heat (POAH).

B. At the POAH.

C. Above the POAH but less than 50 percent.

D. Greater than 50 percent.

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.17 [3.3/3.4]
QID: P1465

Near the end of a fuel cycle, a reactor required three hours to increase power from 70 percent to 100 percent using only reactor coolant system (RCS) boron dilution at the maximum rate to control RCS temperature.

Following a refueling outage, the same reactor power change performed under the same conditions will require a _____ period of time because the rate at which RCS boron concentration can be decreased at the beginning of a fuel cycle is _____.

A. longer; slower

B. shorter; slower

C. longer; faster

D. shorter; faster

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.17 [3.3/3.4]
QID: P1470 (B1371)

With a reactor on a constant startup rate, which one of the following power changes requires the <u>longest</u> time to occur?

A. 1.0×10^{-8} percent to 4.0×10^{-8} percent

B. 5.0×10^{-8} percent to 1.5×10^{-7} percent

C. 2.0×10^{-7} percent to 3.5×10^{-7} percent

D. 4.0×10^{-7} percent to 6.0×10^{-7} percent

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.17 [3.3/3.4]
QID: P1567 (B1570)

With a reactor on a constant startup rate, which one of the following power changes requires the <u>least</u> amount of time to occur?

A. 1.0×10^{-8} percent to 6.0×10^{-8} percent

B. 1.0×10^{-7} percent to 2.0×10^{-7} percent

C. 2.0×10^{-7} percent to 3.5×10^{-7} percent

D. 4.0×10^{-7} percent to 6.0×10^{-7} percent

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.17 [3.3/3.4]
QID: P2069 (B2072)

With a reactor on a constant startup rate, which one of the following power changes requires the <u>longest</u> amount of time to occur?

A. 3.0×10^{-8} percent to 5.0×10^{-8} percent

B. 5.0×10^{-8} percent to 1.5×10^{-7} percent

C. 1.5×10^{-7} percent to 3.0×10^{-7} percent

D. 3.0×10^{-7} percent to 6.0×10^{-7} percent

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.17 [3.3/3.4]
QID: P2168

A reactor is initially stable at the point of adding heat (POAH) with the average reactor coolant temperature at 550°F during a startup. Control rods are manually withdrawn a few inches to increase steam generator steaming rate.

When the reactor stabilizes, reactor power will be _____ the POAH, and average reactor coolant temperature will be _____ 550°F.

A. greater than; equal to

B. greater than; greater than

C. equal to; equal to

D. equal to; greater than

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.17 [3.3/3.4]
QID: P2770 (B2770)

With a reactor on a constant startup rate, which one of the following power changes requires the <u>least</u> amount of time to occur?

A. 3.0×10^{-8} percent to 5.0×10^{-8} percent

B. 5.0×10^{-8} percent to 1.5×10^{-7} percent

C. 1.5×10^{-7} percent to 3.0×10^{-7} percent

D. 3.0×10^{-7} percent to 6.0×10^{-7} percent

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.18 [3.6/3.5]
QID: P869

A nuclear power plant is operating at 100 percent power near the end of a fuel cycle with all control systems in manual. The reactor operator inadvertently adds 100 gallons of boric acid (4 percent by weight) to the reactor coolant system (RCS).

Which one of the following will occur as a result of the boric acid addition? (Assume a constant main generator output.)

A. Pressurizer level will decrease and stabilize at a lower value.

B. RCS pressure will increase and stabilize at a higher value.

C. Reactor power will decrease and stabilize at a lower value.

D. Average RCS temperature will increase and stabilize at a higher value.

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.18 [3.6/3.5]
QID: P1071

A nuclear power plant was operating with the following initial steady-state conditions:

Power level	=	100 percent
Reactor coolant boron concentration	=	620 ppm
Average reactor coolant temperature	=	587°F

After a load decrease, the current steady-state conditions are as follows:

Power level	=	80 percent
Reactor coolant boron concentration	=	650 ppm
Average reactor coolant temperature	=	577°F

Given the following information, how much reactivity was added by control rod movement during the load decrease? (Disregard any changes in fission product poison reactivity.)

Differential boron worth	=	-1.0×10^{-2}	%ΔK/K/ppm
Total power coefficient	=	-1.5×10^{-2}	%ΔK/K/%
Moderator temperature coefficient	=	-2.0×10^{-2}	%ΔK/K/°F

A. 0.0 %ΔK/K

B. -0.2 %ΔK/K

C. -0.6 %ΔK/K

D. -0.8 %ΔK/K

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.18 [3.6/3.5]
QID: P1871

A nuclear power plant was operating with the following initial steady-state conditions:

Power level	=	100 percent
Reactor coolant boron concentration	=	630 ppm
Average reactor coolant temperature	=	582°F

After a load decrease, the current steady-state conditions are as follows:

Power level	=	80 percent
Reactor coolant boron concentration	=	640 ppm
Average reactor coolant temperature	=	577°F

Given the following values, how much reactivity was added by control rod movement during the load decrease? (Assume fission product poison reactivity does not change.)

Total power coefficient	=	-1.5×10^{-2}	%ΔK/K/%
Moderator temperature coefficient	=	-2.0×10^{-2}	%ΔK/K/°F
Differential boron worth	=	-1.5×10^{-2}	%ΔK/K/ppm

A. +0.15 %ΔK/K

B. +0.25 %ΔK/K

C. -0.15 %ΔK/K

D. -0.25 %ΔK/K

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.18 [3.6/3.5]
QID: P1968

A nuclear power plant was operating with the following initial steady-state conditions:

Power level	=	80 percent
Reactor coolant boron concentration	=	630 ppm
Average reactor coolant temperature	=	582°F

After a normal load decrease, the current steady-state conditions are as follows:

Power level	=	50 percent
Reactor coolant boron concentration	=	650 ppm
Average reactor coolant temperature	=	572°F

Given the following values, how much reactivity was added by control rod movement during the load decrease? (Assume fission product poison reactivity does not change.)

Total power coefficient	=	-1.5×10^{-2}	%ΔK/K/%
Moderator temperature coefficient	=	-2.0×10^{-2}	%ΔK/K/°F
Differential boron worth	=	-1.5×10^{-2}	%ΔK/K/ppm

A. -0.5 %ΔK/K

B. -0.15 %ΔK/K

C. -0.25 %ΔK/K

D. -0.35 %ΔK/K

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.18 [3.6/3.5]
QID: P2070

A nuclear power plant was operating with the following initial steady-state conditions:

Power level	=	100 percent
Reactor coolant boron concentration	=	620 ppm
Average reactor coolant temperature	=	587°F

After a load decrease, the current steady-state conditions are as follows:

Power level	=	80 percent
Reactor coolant boron concentration	=	630 ppm
Average reactor coolant temperature	=	577°F

Given the following values, how much reactivity was added by control rod movement during the load decrease? (Assume fission product poison reactivity does not change.)

Total power coefficient	=	-1.5×10^{-2}	%ΔK/K/%
Moderator temperature coefficient	=	-2.0×10^{-2}	%ΔK/K/°F
Differential boron worth	=	-1.0×10^{-2}	%ΔK/K/ppm

A. -0.2 %ΔK/K

B. +0.2 %ΔK/K

C. -0.4 %ΔK/K

D. +0.4 %ΔK/K

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.18 [3.6/3.5]
QID: P3269

One week after a refueling outage, a nuclear power plant is currently operating at 80 percent power with control rods fully withdrawn. During the outage, the entire core was replaced by new fuel assemblies and new burnable poison assemblies were installed at various locations.

Assume reactor power and control rod position do not change during the next week. If no operator action is taken, how and why will average reactor coolant temperature change during the next week?

A. Decrease slowly, due to fuel burnup only.

B. Decrease slowly, due to fuel burnup and fission product poison buildup.

C. Increase slowly, due to burnable poison burnout only.

D. Increase slowly, due to burnable poison burnout and fission product poison decay.

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.19 [3.5/3.6]
QID: P570

How do the following parameters change during a normal ramp of reactor power from 15 percent to 75 percent?

	Main Turbine First Stage Pressure	Reactor Coolant System Boron Concentration
A.	Increases	Decreases
B.	Decreases	Decreases
C.	Increases	Increases
D.	Decreases	Increases

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.19 [3.5/3.6]
QID: P1672 (B1671)

A refueling outage has just been completed, during which one-third of the core was replaced with new fuel assemblies. A reactor startup has been performed to begin the sixth fuel cycle, and reactor power is being increased to 100 percent.

Which one of the following pairs of reactor fuels will provide the greatest contribution to core heat production when the reactor reaches 100 percent power?

A. U-235 and U-238

B. U-238 and Pu-239

C. U-235 and Pu-239

D. U-235 and Pu-241

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.19 [3.5/3.6]
QID: P2272

A nuclear power plant is operating at 100 percent power near the end of a fuel cycle. The greatest contribution to core heat production is being provided by the fission of...

A. U-235 and U-238.

B. U-235 and Pu-239.

C. U-238 and Pu-239.

D. U-238 and Pu-241.

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.19 [3.5/3.6]
QID: P2868

A refueling outage has just been completed, during which the entire core was offloaded and replaced with new fuel. A reactor startup has been performed and power is being increased to 100 percent.

Which one of the following pairs of reactor fuels will provide the greatest contribution to core heat production when the reactor reaches 100 percent power?

A. U-235 and U-238

B. U-238 and Pu-239

C. U-235 and Pu-239

D. U-235 and Pu-241

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.20 [3.8/3.9]
QID: P271

A reactor is critical at 2.0×10^{-8} percent power. The operator withdraws rods as necessary to immediately establish and maintain a positive 0.1 dpm startup rate. How long will it take the reactor to reach 7.0×10^{-8} percent power?

A. 2.4 minutes

B. 5.4 minutes

C. 7.4 minutes

D. 10.4 minutes

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.20 [3.8/3.9]
QID: P2869

A reactor is critical at 3.0×10^{-8} percent power. The operator withdraws rods as necessary to immediately establish and maintain a positive 0.1 dpm startup rate. How long will it take the reactor to reach 7.0×10^{-8} percent power?

A. 3.7 minutes

B. 5.4 minutes

C. 6.7 minutes

D. 8.4 minutes

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.20 [3.8/3.9]
QID: P2970

A reactor startup is in progress and criticality has just been achieved. After recording the critical rod heights, the operator withdraws control rods for 20 seconds to establish a stable positive 0.5 dpm startup rate (SUR). One minute later (prior to reaching the point of adding heat), the operator inserts the same control rods for 25 seconds.

During the rod insertion, when will the SUR become negative?

A. Immediately when the control rod insertion is initiated.

B. After the control rods pass through the critical rod height.

C. Just as the control rods pass through the critical rod height.

D. Prior to the control rods passing through the critical rod height.

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.21 [3.6/3.8]
QID: P272

A nuclear power plant has been operating at 75 percent power for several weeks when a partial main steam line break occurs that releases 3 percent of rated steam flow. Assuming no operator or automatic actions occur, reactor power will stabilize _____ 75 percent; and average reactor coolant temperature will stabilize at a _____ temperature.

A. greater than; higher

B. at; higher

C. greater than; lower

D. at; lower

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.21 [3.6/3.8]
QID: P368

A reactor is critical at a stable power level below the point of adding heat (POAH). An unisolable steam line break occurs and 3 percent of rated steam flow is escaping.

Assuming no reactor trip, which one of the following describes the response of the reactor?

A. Reactor coolant average temperature will decrease. The reactor will become subcritical.

B. Reactor coolant average temperature will remain the same. The reactor will stabilize at 3 percent power.

C. Reactor coolant average temperature will decrease. The reactor will stabilize at 3 percent power.

D. Reactor coolant average temperature will decrease. Reactor power will not change because the reactor was below the POAH.

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.21 [3.6/3.8]
QID: P1370

A nuclear power plant has been operating at 80 percent power for several weeks when a partial steam line break occurs that releases 2 percent of rated steam flow. Main turbine load and control rod position remain the same.

Assuming no operator or protective actions occur, when the plant stabilizes reactor power will be _____; and average reactor coolant temperature will be _____.

A. higher; higher

B. unchanged; higher

C. higher; lower

D. unchanged; lower

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.21 [3.6/3.8]
QID: P1570

A nuclear power plant is operating at steady-state 85 percent power and 580°F average reactor coolant temperature (T_{ave}) near the end of a fuel cycle. A failure of the turbine control system opens the turbine control valves to admit 10 percent more steam flow to the main turbine. No operator actions occur and no protective system actuations occur. Rod control is in manual.

Following the transient, reactor power will stabilize _____ 85 percent; and T_{ave} will stabilize _____ 580°F.

A. above; above

B. above; below

C. below; above

D. below; below

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.21 [3.6/3.8]
QID: P2372

A nuclear power plant is operating at steady-state 90 percent power near the end of a fuel cycle with manual rod control when a turbine control system malfunction opens the main turbine steam inlet valves an additional 5 percent. Reactor power will initially...

A. increase, because the rate of neutron absorption in the moderator initially decreases.

B. increase, because the rate of neutron absorption at U-238 resonant energies initially decreases.

C. decrease, because the rate of neutron absorption in the moderator initially increases.

D. decrease, because the rate of neutron absorption at U-238 resonant energies initially increases.

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.21 [3.6/3.8]
QID: P2671

A nuclear power plant is operating at 100 percent power near the end of a fuel cycle when the main turbine trips. If the reactor does <u>not</u> immediately trip, which one of the following will act <u>first</u> to change reactor power?

A. Positive reactivity addition from the Doppler coefficient will cause reactor power to initially increase.

B. Positive reactivity addition from the moderator temperature coefficient will cause reactor power to initially increase.

C. Negative reactivity addition from the Doppler coefficient will cause reactor power to initially decrease.

D. Negative reactivity addition from the moderator temperature coefficient will cause reactor power to initially decrease.

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.21 [3.6/3.8]
QID: P2771

A nuclear power plant is operating at steady-state 80 percent power and 580°F average reactor coolant temperature (T_{ave}) near the end of a fuel cycle with manual rod control. A turbine control system malfunction partially closes the turbine control valves resulting in 5 percent less steam flow to the main turbine. No operator actions occur and no protective system actuations occur.

Following the transient, reactor power will stabilize _____ 80 percent; and T_{ave} will stabilize _____ 580°F.

A. at; above

B. at; below

C. below; above

D. below; below

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.21 [3.6/3.8]
QID: P3171

A nuclear power plant is operating at steady-state 60 percent power in the middle of a fuel cycle with manual rod control when a turbine control system malfunction closes the turbine steam inlet valves an additional 5 percent. Which one of the following is most responsible for the initial reactor power decrease?

A. The rate of neutron absorption by core xenon-135 initially increases.

B. The rate of neutron absorption by the moderator initially increases.

C. The rate of neutron absorption by the fuel at resonance energies initially increases.

D. The rate of neutron absorption by the boron in the reactor coolant initially increases.

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.21 [3.6/3.8]
QID: P3484

A multi-loop nuclear power plant is operating at steady-state 50 percent power with manual rod control when the main steam isolation valve (MSIV) for one steam generator inadvertently closes. Assume that no reactor trip or other protective action occurs, and no operator action is taken.

Immediately after the MSIV closure, the cold leg temperature (T_{cold}) in the reactor coolant loop with the closed MSIV will initially _____; and the T_{cold} in a loop with an open MSIV will initially _____.

A. decrease; increase

B. decrease; decrease

C. increase; increase

D. increase; decrease

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.21 [3.6/3.8]
QID: P4035

A nuclear power plant is operating at steady-state 60 percent power in the middle of a fuel cycle with manual rod control when a turbine control system malfunction opens the main turbine steam inlet valves an additional 5 percent. Which one of the following is responsible for the initial reactor power increase?

A. The rate of neutron absorption by core Xe-135 initially decreases.

B. The rate of neutron absorption in the moderator initially decreases.

C. The rate of neutron absorption at U-238 resonance energies initially decreases.

D. The rate of neutron absorption by the boron in the reactor coolant initially decreases.

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.21 [3.6/3.8]
QID: P4735

A nuclear power plant is initially operating at steady-state 100 percent reactor power with the main generator producing 1,100 MW. A power grid disturbance occurs and appropriate operator actions are taken. The plant is stabilized with the following current conditions:

- Main generator output is 385 MW.
- Steam dump/bypass system is discharging 15 percent of rated steam flow to the main condenser.
- All reactor coolant system parameters are in their normal ranges.

What is the approximate current reactor power level?

A. 15 percent

B. 35 percent

C. 50 percent

D. 65 percent

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.22 [2.6/3.8]
QID: P1072

A high boron concentration is necessary at the beginning of a fuel cycle to...

A. compensate for excess reactivity in the fuel.

B. produce a negative moderator temperature coefficient.

C. flatten the axial and radial neutron flux distributions.

D. maximize control rod worth until fission product poisons accumulate.

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.22 [2.6/3.8]
QID: P2570

During a refueling outage, new fuel assemblies with higher enrichments of U-235 were loaded to prolong the fuel cycle from 12 months to 16 months. What is a possible consequence of offsetting all the excess positive reactivity of the new fuel assemblies with a higher concentration of boron in the reactor coolant?

A. Boron may precipitate out of the reactor coolant during a cooldown.

B. An RCS temperature decrease may result in a negative reactivity addition.

C. Power changes requiring dilution of RCS boron may take longer.

D. The differential boron worth ($\Delta K/K$/ppm) may become positive.

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.23 [2.9/3.1]
QID: P71 (B72)

Shortly after a reactor trip, reactor power indicates 5.0×10^{-2} percent when a stable negative startup rate is attained. Approximately how much additional time is required for reactor power to decrease to 5.0×10^{-3} percent?

A. 90 seconds

B. 180 seconds

C. 270 seconds

D. 360 seconds

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.23 [2.9/3.1]
QID: P572 (B2272)

A nuclear power plant has been operating at 100 percent power for several weeks when a reactor trip occurs. How much time will be required for core decay heat production to decrease to one percent power following the trip?

A. 1 to 8 seconds

B. 1 to 8 minutes

C. 1 to 8 hours

D. 1 to 8 days

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.23 [2.9/3.1]
QID: P770 (B771)

Which one of the following determines the value of the stable negative startup rate observed shortly after a reactor trip?

A. The shortest-lived delayed neutron precursors.

B. The longest-lived delayed neutron precursors.

C. The shutdown margin just prior to the trip.

D. The worth of the inserted control rods.

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.23 [2.9/3.1]
QID: P1965 (B1369)

Shortly after a reactor trip, reactor power indicates 1.0×10^{-3} percent when a stable negative startup rate is attained. Reactor power will decrease to 1.0×10^{-4} percent in approximately _____ seconds.

A. 380

B. 280

C. 180

D. 80

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.23 [2.9/3.1]
QID: P2171 (B1770)

Following a reactor trip, reactor power indicates 0.1 percent when the typical stable post-trip startup rate is observed. Approximately how much additional time is required for reactor power to decrease to 0.05 percent?

A. 24 seconds

B. 55 seconds

C. 173 seconds

D. 240 seconds

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.23 [2.9/3.1]
QID: P2672 (B131)

Which one of the following approximates the fission product decay heat produced in a reactor at one second and one hour following a reactor trip from long-term operation at 100 percent power?

	One Second	One Hour
A.	15 percent	1 percent
B.	7 percent	1 percent
C.	1 percent	0.1 percent
D.	0.5 percent	0.1 percent

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.23 [2.9/3.1]
QID: P2768 (B2769)

Reactors A and B are identical and have operated at 100 percent power for six months when a reactor trip occurs simultaneously on both reactors. All control rods fully insert, except for one reactor B control rod that remains fully withdrawn.

Which reactor, if any, will have the smaller negative startup rate five minutes after the trip, and why?

A. Reactor A, due to the greater shutdown reactivity.

B. Reactor B, due to the smaller shutdown reactivity.

C. Both reactors will have the same startup rate because both reactors will be stable at a power level low in the source range.

D. Both reactors will have the same startup rate because only the longest-lived delayed neutron precursors will be releasing fission neutrons.

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.23 [2.9/3.1]
QID: P2969

Reactors A and B are identical and have operated at 100 percent power for six months when a reactor trip occurs simultaneously on both reactors. All reactor A control rods fully insert. One reactor B control rod sticks fully withdrawn.

Which reactor, if any, will have the smaller negative startup rate five minutes after the trip, and why?

A. Reactor A, because its delayed neutron fraction will be smaller.

B. Reactor B, because its delayed neutron fraction will be larger.

C. Both reactors will have the same startup rate because both reactors will be stable at a power level low in the source range.

D. Both reactors will have the same startup rate because only the longest-lived delayed neutron precursors will be releasing fission neutrons.

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.23 [2.9/3.1]
QID: P3271 (B3271)

Reactors A and B are identical and have operated at 100 percent power for six months when a reactor trip occurs simultaneously on both reactors. All reactor A control rods fully insert. One reactor B control rod sticks fully withdrawn, but all others fully insert.

When compared to reactor B at five minutes after the trip, the fission rate in reactor A will be _____; and the startup rate in reactor A will be _____.

A. the same; more negative

B. the same; the same

C. smaller; more negative

D. smaller; the same

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.23 [2.9/3.1]
QID: P3468

A reactor is critical just below the point of adding heat when an inadvertent reactor trip occurs. All control rods fully insert except for one rod, which remains fully withdrawn. Five minutes after the reactor trip, with reactor startup rate (SUR) stable at approximately -1/3 dpm, the remaining withdrawn control rod suddenly drops (fully inserts).

Which one of the following describes the reactor response to the drop of the last control rod?

A. SUR will remain stable at approximately -1/3 dpm.

B. SUR will immediately become more negative, and then return to and stabilize at approximately -1/3 dpm.

C. SUR will immediately become more negative, and then turn and stabilize at a value more negative than -1/3 dpm.

D. SUR will immediately become more negative, and then turn and stabilize at a value less negative than -1/3 dpm.

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.23 [2.9/3.1]
QID: P7035

A nuclear power plant is operating at steady-state 100 percent power when a reactor trip occurs. As a result of the trip, the core neutron flux will initially decrease at a startup rate that is much _____ negative than -1/3 dpm; the startup rate will become approximately -1/3 dpm about _____ minutes after the trip.

A. less; 3

B. less; 30

C. more; 3

D. more; 30

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.23 [2.9/3.1]
QID: P7618 (B7618)

Refer to the graph of neutron flux versus time (see figure below) for a nuclear power plant reactor that experienced a reactor trip from extended full power operation at time = 0 seconds. The neutron flux axis has a logarithmic scale while the time axis has a linear scale.

Which section(s) of the curve has/have a slope that is primarily determined by the production rate of delayed neutrons?

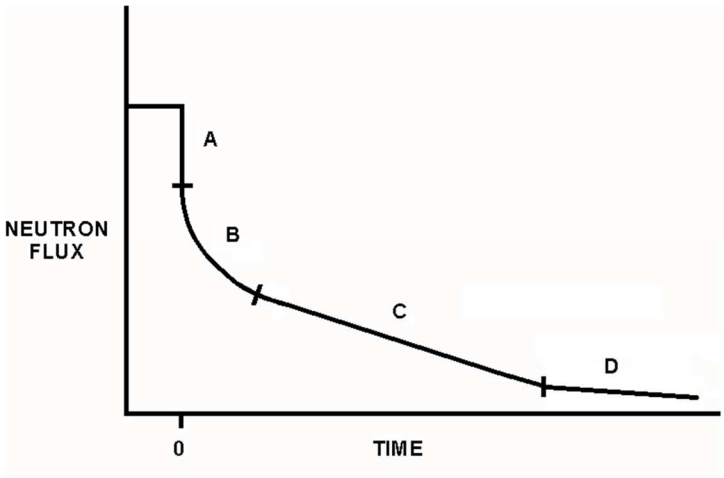
A. B only

B. B and C

C. C only

D. C and D

ANSWER: B.



TOPIC: 192008
KNOWLEDGE: K1.23 [2.9/3.1]
QID: P7658 (B7658)

Refer to the graph of neutron flux versus time (see figure below) for a nuclear power plant that experienced a reactor trip from extended full power operation at time = 0 seconds. The neutron flux axis has a logarithmic scale while the time axis has a linear scale.

In which section of the curve does the production rate of source neutrons primarily determine the slope of the curve?

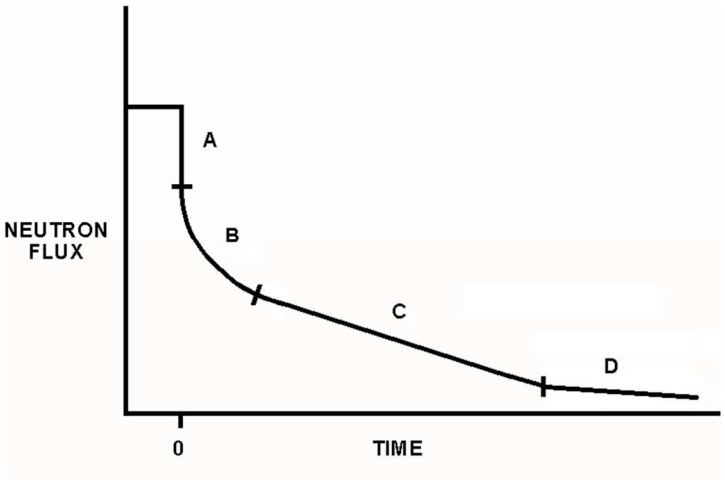
A. A

B. B

C. C

D. D

ANSWER: D.



TOPIC: 192008
KNOWLEDGE: K1.23 (2.9/3.1)
QID: P7708 (B7708)

A reactor was operating for several months at 100 percent power when a reactor trip occurred. Which one of the following is primarily responsible for the startup rate value 2 minutes after the trip?

A. The K_{eff} in the core.

B. The rate of source neutron production in the core.

C. The effective delayed neutron fraction in the core.

D. The decay rates of the delayed neutron precursors in the core.

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.24 [3.5/3.6]
QID: P672 (B1969)

A reactor is critical below the point of adding heat when a fully withdrawn control rod fully inserts into the core. Assuming no operator or automatic actions, core neutron flux will slowly decrease to...

A. zero.

B. an equilibrium value less than the source neutron flux.

C. an equilibrium value greater than the source neutron flux.

D. a slightly lower value, then slowly return to the initial value.

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.24 [3.5/3.6]
QID: P1472

A reactor is critical just below the point of adding heat when a single fully withdrawn control rod drops into the core. Assuming no operator or automatic actions occur, when the plant stabilizes reactor power will be _____; and average reactor coolant temperature will be _____.

A. the same; the same

B. the same; lower

C. lower; the same

D. lower; lower

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.24 [3.5/3.6]
QID: P5136

A reactor is initially critical in the source range during a reactor startup when the control rods are inserted a small amount. Reactor startup rate stabilizes at -0.15 dpm. Assuming startup rate remains constant, how long will it take for source range count rate to decrease by one-half?

A. 0.3 minutes

B. 2.0 minutes

C. 3.3 minutes

D. 5.0 minutes

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.25 [2.9/3.1]
QID: P772

Which one of the following is the reason for inserting control rods in a predetermined sequence during a normal reactor shutdown?

A. To prevent uneven fuel burnup.

B. To prevent an excessive reactor coolant system cooldown rate.

C. To prevent abnormally high local power peaks.

D. To prevent divergent xenon-135 oscillations.

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.25 [2.9/3.1]
QID: P2971

Which one of the following describes the process for inserting control rods during a normal reactor shutdown?

A. Control rods are inserted in reverse order, one bank at a time, to maintain acceptable power distribution.

B. Control rods are inserted in reverse order, one bank at a time, to maintain a rapid shutdown capability from the remainder of the control rods.

C. Control rods are inserted in reverse order, in a bank overlapping sequence, to maintain a relatively constant differential control rod worth.

D. Control rods are inserted in reverse order, in a bank overlapping sequence, to limit the amount of positive reactivity added during a rod ejection accident.

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.26 [3.1/3.2]
QID: P370 (B372)

After one month of operation at 100 percent power, the fraction of rated thermal power being produced from the decay of fission products in an operating reactor is...

A. greater than 10 percent.

B. greater than 5 percent, but less than 10 percent.

C. greater than 1 percent, but less than 5 percent.

D. less than 1 percent.

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.27 [3.1/3.4]
QID: P132

The magnitude of decay heat generation is determined primarily by...

A. core burnup.

B. power history.

C. final power at shutdown.

D. control rod worth at shutdown.

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.27 [3.1/3.4]
QID: P1272 (B1372)

Following a reactor shutdown from three months of operation at 100 percent power, the core decay heat production rate will depend on the...

A. amount of fuel that has been depleted.

B. decay rate of the fission product poisons.

C. time elapsed since K_{eff} decreased below 1.0.

D. decay rate of the photoneutron source.

ANSWER: C.

TOPIC: 192008
KNOWLEDGE: K1.27 [3.1/3.4]
QID: P1372

A nuclear power plant had been operating at 100 percent power for six months when a steam line rupture occurred that resulted in a reactor trip and all steam generators (SGs) blowing down (emptying) after approximately 1 hour. The SG blowdown caused reactor coolant system (RCS) temperature to decrease to 400°F, at which time the SGs became empty and an RCS heatup began.

Given the following information:

Reactor rated thermal power	=	3,400 MWt
Decay heat rate	=	1.0 percent rated thermal power
Reactor coolant pump heat input to the RCS	=	15 MWt
RCS total heat loss rate	=	Negligible
RCS specific heat	=	1.1 Btu/lbm-°F
RCS inventory (less pressurizer)	=	475,000 lbm

What will the average RCS heatup rate be during the 5 minutes immediately after all SGs became empty? (Assume <u>no</u> heat removal from the RCS.)

A. 8 to 15°F/hr

B. 50 to 75°F/hr

C. 100 to 150°F/hr

D. 300 to 350°F/hr

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.27 [3.1/3.4]
QID: P2572

A nuclear power plant had been operating at 100 percent power for six months when a steam line rupture occurred that resulted in a reactor trip and all steam generators (SGs) blowing down (emptying) after approximately 1 hour. The SG blowdown caused reactor coolant system (RCS) temperature to decrease to 400°F, at which time the SGs became empty and an RCS heatup began.

Given the following information:

Reactor rated thermal power	=	2,400 MWt
Decay heat rate	=	1.0 percent rated thermal power
Reactor coolant pump heat input to the RCS	=	13 MWt
RCS total heat loss rate	=	2.4 MWt
RCS specific heat	=	1.1 Btu/lbm-°F
RCS inventory (less pressurizer)	=	325,000 lbm

What will the average RCS heatup rate be during the 5 minutes immediately after all SGs became empty? (Assume no heat removal from the RCS.)

A. 8 to 15°F/hr

B. 25 to 50°F/hr

C. 80 to 150°F/hr

D. 300 to 400°F/hr

ANSWER: D.

TOPIC: 192008
KNOWLEDGE: K1.27 [3.1/3.4]
QID: P2872 (B2872)

A reactor has been shut down for several weeks when a loss of all AC power results in a loss of forced coolant flow in the reactor coolant system (RCS).

Given the following information:

Reactor rated thermal power	=	2,800 MWt
Decay heat rate	=	0.2 percent rated thermal power
RCS ambient heat loss rate	=	2.4 MWt
RCS specific heat	=	1.1 Btu/lbm-°F
RCS inventory (less pressurizer)	=	325,000 lbm

What will the average reactor coolant heatup rate be during the 20 minutes immediately after forced decay heat removal flow is lost? Assume the RCS remains in thermal equilibrium and that <u>only</u> ambient losses are removing heat from the RCS.

A. Less than 25°F/hour

B. 26 to 50°F/hour

C. 51 to 75°F/hour

D. More than 76°F/hour

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.27 [3.1/3.4]
QID: P2972 (B2972)

A nuclear power plant has been operating for one hour at 50 percent power following six months of operation at steady-state 100 percent power. What percentage of rated thermal power is currently being generated by fission product decay?

A. 1 percent to 2 percent

B. 3 percent to 5 percent

C. 6 percent to 8 percent

D. 9 percent to 11 percent

ANSWER: B.

TOPIC: 192008
KNOWLEDGE: K1.27 [3.1/3.4]
QID: P4336 (B4336)

A nuclear power plant has been operating at 100 percent power for six months when a reactor trip occurs. Which one of the following describes the source(s) of core heat generation 30 minutes after the reactor trip?

A. Fission product decay is the <u>only</u> significant source of core heat generation.

B. Delayed neutron-induced fission is the <u>only</u> significant source of core heat generation.

C. Fission product decay and delayed neutron-induced fission are <u>both</u> significant sources and produce approximately equal rates of core heat generation.

D. Fission product decay and delayed neutron-induced fission are <u>both</u> insignificant sources and generate core heat at rates that are less than the rate of ambient heat loss from the core.

ANSWER: A.

TOPIC: 192008
KNOWLEDGE: K1.27 [3.1/3.4]
QID: P7638

A nuclear power plant has been operating at 100 percent power for six months when a reactor trip occurs. Which one of the following describes the source(s) of core heat generation 1 minute after the reactor trip?

A. Fission product decay is the only heat source capable of increasing fuel temperature.

B. Delayed neutron-induced fission is the only heat source capable of increasing fuel temperature.

C. Both fission product decay and delayed neutron-induced fission are capable of increasing fuel temperature.

D. Neither fission product decay nor delayed neutron-induced fission are capable of increasing fuel temperature.

ANSWER: C.